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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 857

Contribution from the Bureau of Markets
GEORGE LIVINGSTON, Acting Chief

Washington, D. C. PROFESSIONAL PAPER June 25, 1920

A MODIFIED BOERNER SAMPLER.

By E. G. Boerner, *In Charge, Grain Investigations*, and E. H. Ropes, *Specialist in Grain Investigations.*

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INTRODUCTION.

The device described in this bulletin was developed primarily to meet the demands of grain dealers and laboratory workers for a cheap and simple method of securing from a larger sample to be graded a smaller representative portion of grain for testing and analyses purposes. Another application of the device, which should be of special interest to the grain trade, is that a sample can be divided into two or more representative parts, so that one representative part may be used for testing and grading and the other part or parts may be turned over to the seller or the buyer of the grain, or retained for future reference. It can also be used for reducing the size of samples of seeds, flour, meal, feeds, or any other material of like kind for examination or analyses. This device should be of special interest to country grain dealers. A phantom view of the device completely assembled in operation is shown in figure 1.

The device (commonly known to the trade as the "Boerner Sampler") described in Department of Agriculture Bulletin No. 287 was developed primarily for the purpose of dividing an original sample into smaller portions, which might be analyzed without the undue loss of time incident to handling a large sample, and to make this division in such a manner that each small portion would correctly retain the original proportion of the various factors comprising the

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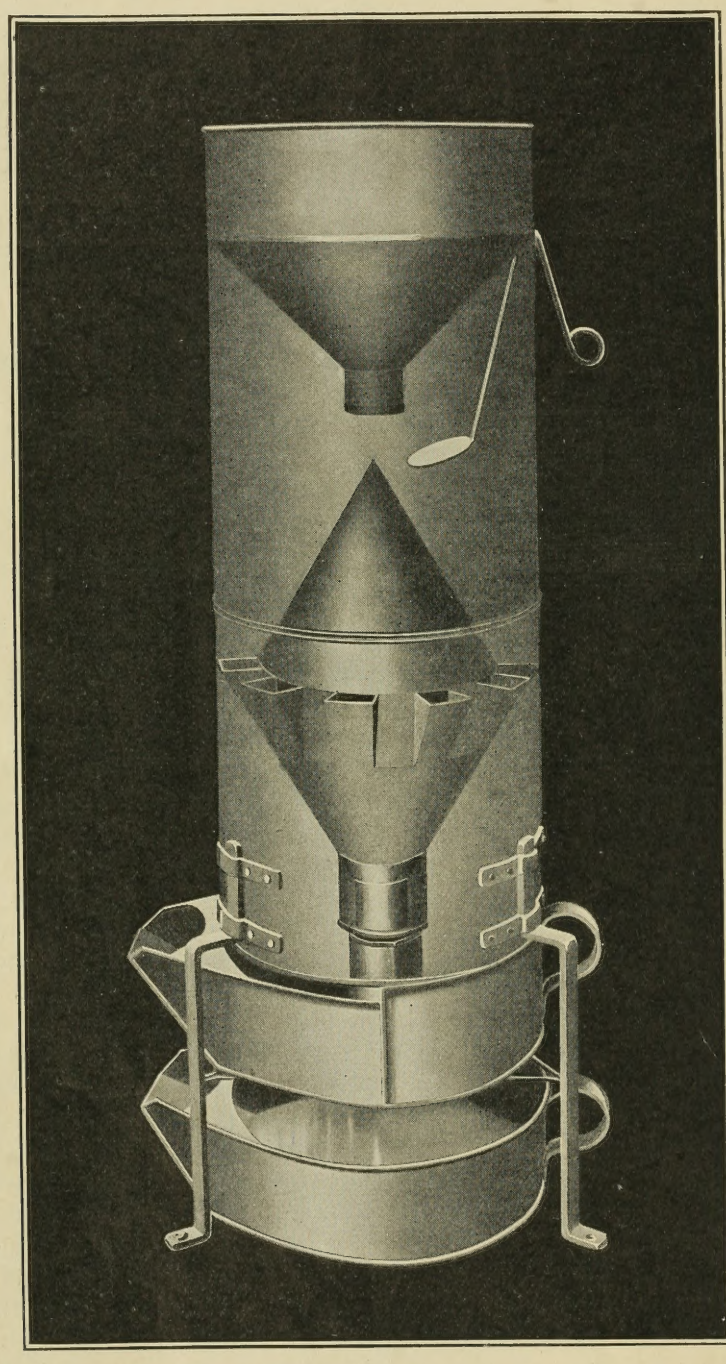

FIG. 1.—Phantom view of device. American manufacturers and users of this device are protected by a public-service patent.

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original sample. The original standard design is more complicated to manufacture than the modified sampler here described, but it is so constructed that it is somewhat more convenient to work with. It is used at all offices of Federal Grain Supervision, and is recommended for grain inspection departments and others who have to do a large amount of grading or testing.

During the past few years the increased cost of material and labor has caused the cost of the original standard device to advance to such an extent that many grain dealers, especially country grain dealers, have not felt justified in purchasing it.

Following the Department of Agriculture's policy of bringing the equipment necessary for correct grading within the financial reach of all persons concerned, the original standard design for this device has been modified so as to cheapen its construction materially and bring its cost within the reach of all persons interested in grain grading.

The first essential in the accurate grading of grain is the securing of a representative sample of the lot or parcel of grain to be graded. A representative sample varies in size somewhat as the bulk of the lot to be sampled varies. For the weight per bushel test or dockage determination, the quantity of the sample to be used is fairly large, and for these tests reduction in size may not always be necessary, but in every case the amount of the sample is many times larger than can be conveniently analyzed or tested for such factors as foreign material, other grains, damaged kernels, or moisture content. In order to obtain a portion small enough for these analyses and tests it is essential that the size of the original sample be reduced.

Mere haphazard reduction of size of sample, however, leads only to confusion and disputes between the interested parties. Among haphazard methods of cutting down the size of the sample might be mentioned: Pouring out a portion of the sample; taking out a portion with a scoop or with the hand; dividing the sample with a ruler; or any other solely manual method. When a small portion is taken out of a larger sample by any of these methods it almost invariably results in removing either too great or too small a proportion of foreign matter, broken grains, damaged kernels, and admixtures of other grains; and even though this may not in some cases affect the result of certain tests, as for instance the moisture test, it may, and usually does, seriously affect the correct proportion of the admixtures in the remaining portion of the sample upon which the other tests are based, and incorrect grading is a common result.

The reduction of the size of the original sample for analysis and testing is generally necessary and the retention of the relative proportions of the admixture of various other grains, foreign substances, broken kernels, and damaged kernels, of which the original was made

up, is in such cases absolutely essential to correct grading; but without the aid of a mechanical device the retention of correct proportions with such a reduction is hardly possible.

One familiar with grain grading knows that to obtain uniform results the tests and analyses must be made on samples obtained in a uniform manner. It is surprising how slight a variation in the method of obtaining either the original sample or a portion of the sample for certain tests will cause a difference in the result; yet we find many methods in everyday use, when the country as a whole is considered.

To grade grain accurately requires not only a thorough knowledge of the grain to be graded and the grade requirements, but also accurate determinations of the grading factors, and for these determinations proper apparatus is necessary. A sample-splitting device for reducing the size of a sample for analyses and testing is considered essential for correct grain grading, and for reasons already explained the modified device described in this bulletin was designed especially for use by country grain dealers.

DESCRIPTION.

The modified sampler consists primarily of the following parts: Two cylinders partially nesting or telescoping; two pans, or containers; and three legs. The upper cylinder with its parts forms a hopper with gate; the lower cylinder contains a spreading cone, diverting ducts, and a funnel. Figure 2 shows the device completely assembled and ready for operation.

The upper cylinder is designed to slide down inside of the lower cylinder until it rests upon the partitions of the diverting ducts arranged around the base of the cone, where it is held in proper position. A funnel is set down inside of the upper cylinder so that with the cylinder it forms a hopper of ample capacity, shown in figure 3. This hopper is provided at its bottom with a gate that may be opened or closed by means of a convenient handle extending through to the outside of the cylinder. A bottom view of the hopper and gate is shown in figure 4.

The lower cylinder contains the spreading cone, and holds it so that its point is directly under the center of the opening in the bottom of the hopper in the upper cylinder. The diameter of the spreading cone at its base is less than the diameter of the cylinder, and the space between the cone and cylinder is subdivided into a given number of equal spaces by radial partitions extending from the base of the cone to the cylinder wall. The arrangement of the partitions as shown in figure 3 is such that any material passing through the device, by way of the hopper, and sliding down over the surface of the cone, is divided into as many equal streams as there are spaces between the partitions around the base of the cone. Every other

stream of material falls into one pan, while the alternate streams are diverted into the other pan, thus dividing the original material (sample) into two equal parts. The separation of the streams is accomplished by leaving the openings between the radial partitions unobstructed in every other space, and in the alternate spaces, between those left clear, providing bottoms which, with the partition as sides, form diverting ducts. The streams of material passing through the unobstructed openings fall directly into the upper pan. The streams passing through the ducts are diverted into a funnel, shown in figure 4, which collects the streams from all the ducts and discharges them as one stream (which is one-half of the original material) into the lower pan through a protected opening in the upper pan..

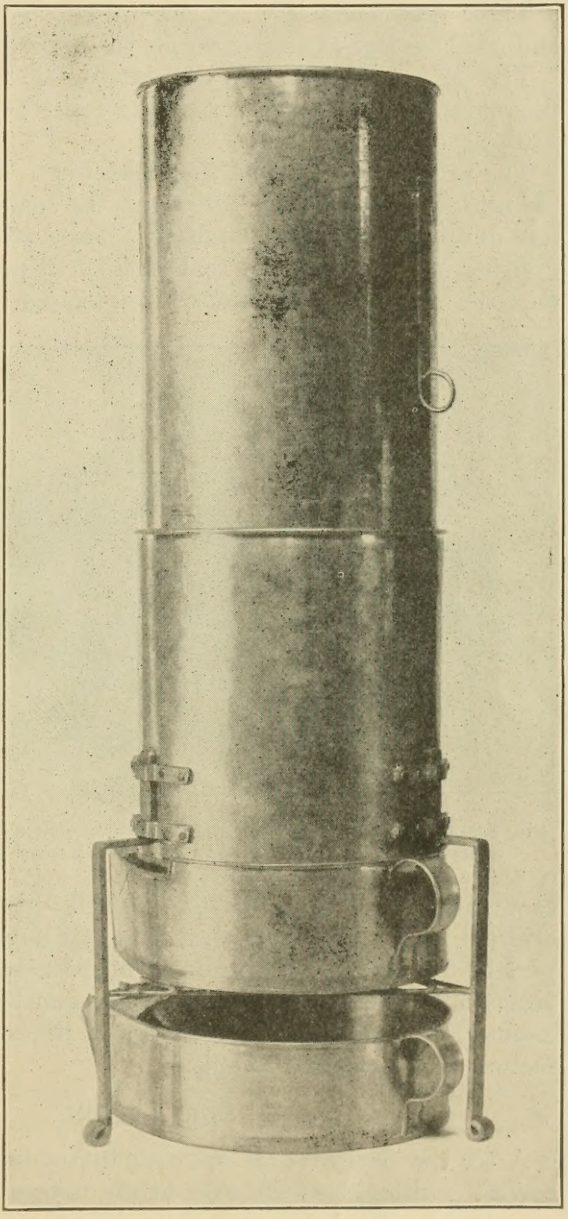

FIG. 2.—Side view of complete device.

The upper pan, illustrated in figure 5, is designed so that it catches and holds the half of the material passing through the unobstructed openings, but permits the other half of the material, which has passed through

the diverting ducts and funnel, to fall into the lower pan through a protected opening. The lower pan, also shown in figure 5, is a simple receptacle with a handle and a pouring spout.

Three detachable legs are provided to carry the lower cylinder, and on these legs are supports for the upper pan.

The device can be made of brass or block tin, but the material used must be of sufficient stiffness to resist bending or denting under working conditions.

The primary purpose of this device is to divide an original sample into smaller portions, which may be analyzed without the undue loss of time incident to handling a large sample, and to make this division in such a manner that each small portion will correctly retain the original proportion or percentage of the various factors

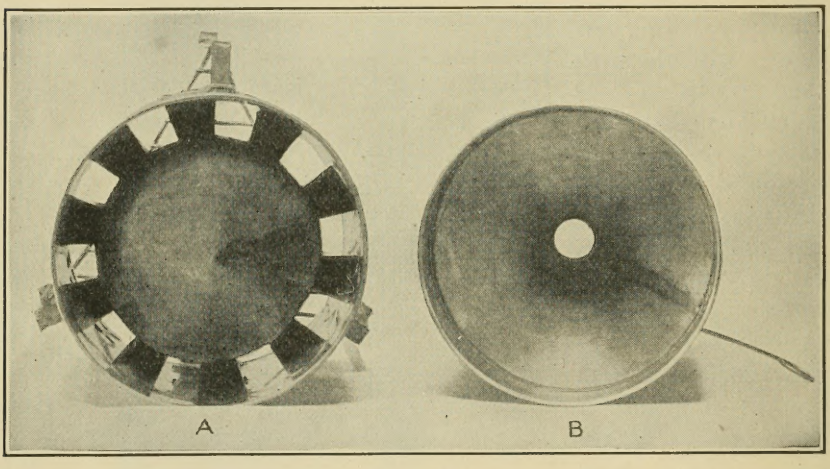

FIG. 3.—*A*, Top view of lower cylinder showing cone and arrangement of ducts and openings. *B*, Top view of upper cylinder showing hopper and gate (open).

comprising the original sample. If the correct proportions of the original factors are retained, it is not an indication of failure on the part of the device if the grain or other material is not divided into absolutely equal parts every time it is run through the sampler, the essential feature being the retention of the correct proportion of the factors of the original sample.

OPERATION.

After the device is set up with the cylinders, legs, and pans in correct position, and the gate in the hopper closed and locked, the sample to be divided is poured into the upper hopper.

Then the gate should be opened and swung clear of the opening, that the sample may fall through the opening in the hopper onto the point of the cone, where it slides over the entire surface of the cone

in a shallow sheet and is divided into as many streams as there are spaces between the partitions at the base of the cone. As every alternate stream falls into one pan, and the intermediate streams are diverted into the other pan, the sample will be divided into approximately equal parts. In order to further divide the sample, it will be necessary only to close the gate and pour the contents of one of the pans—the lower pan will be found to be more convenient to use for this purpose—into the hopper, replace the pan, open the gate, and let that half of the original sample run through the device again. This action can be repeated, pouring always from the same pan, until the quantity of the sample deposited in one pan is the amount desired for analysis. By various combinations, pouring from

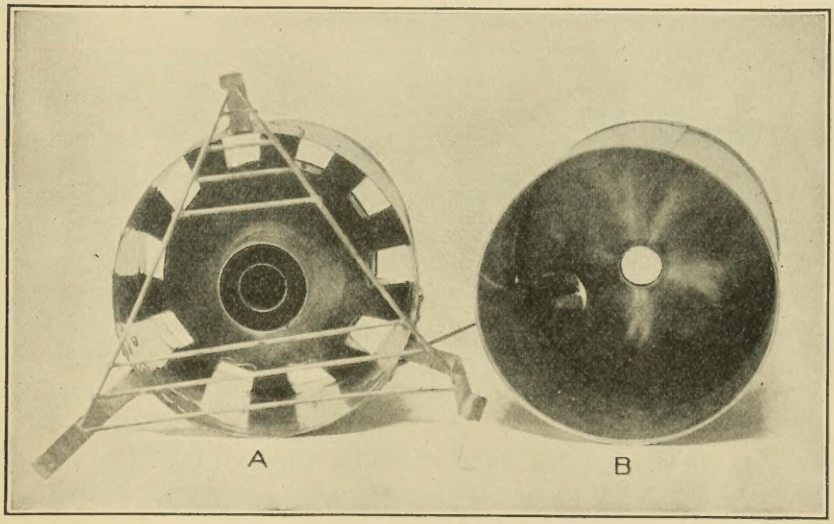

FIG. 4.—*A*, Botton view of lower cylinder, showing spout at bottom of funnel and shield surrounding this spout. *B*, Bottom view, upper cylinder, showing bottom of hopper with gate open.

the same pan every time, as described, or by sometimes using the other, almost any desired size of sample can be obtained,[1] provided the entire contents of the pan being emptied are poured into the upper hopper each time.

For instance, if the weight of the original sample is 1,000 grams, and it is desired to obtain approximately 30 grams for analysis, the sample should be poured through, or "cut" as it is commonly called, five times. The first cut starts with 1,000 grams, giving 500 grams in each pan; the second cut starts with 500 grams, giving 250 grams in the pan just emptied, and 750 grams in the other; the third cut

[1] U. S. Department of Agriculture Bulletin 574 will be found convenient for use in grain grading in connection with this apparatus, as it contains tables of the conversion of the weights of mechanical separations of grains into percentages.

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gives, respectively, 125 grams and 875 grams; the fourth cut, [illegible] grams and 937.5 grams; the fifth cut, 31.25 grams and 968.75 grams. These weights may vary slightly in amount, as previously explained, but this will not affect the accuracy of the portion.

CARE OF THE DEVICE.

As there are practically no moving parts to this device it requires little care except to keep it clean. If the openings around the base of the cone, or the ducts, are allowed to become choked or partially clogged by pieces of straw, corncob, etc., the accuracy of the results may be vitally affected.

With the present device it is a simple matter to lift out the upper cylinder, examine the openings and ducts around the base of the cone, and remove any obstructions lodged there. This precaution

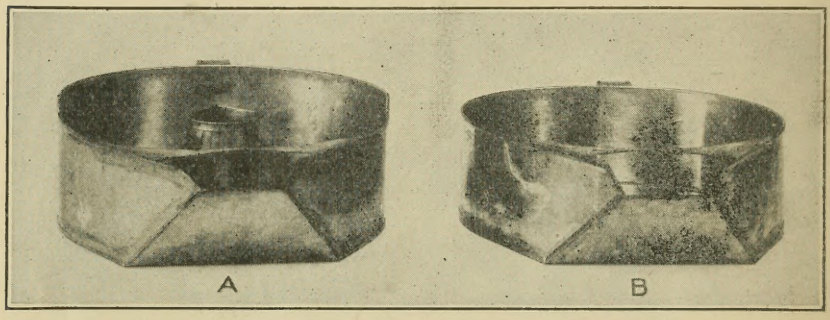

FIG. 5.—*A*, Upper pan, showing protected opening through which material passes to pan. *B*, Lower pan.

should never be neglected, as it affects the correctness of the sample and, by so doing, the analysis and grading of the grain in question.

HOW TO OBTAIN THE SAMPLER.

This device is covered by the same public-service patent as is the original standard apparatus described in Department of Agriculture Bulletin No. 287, and anyone in the United States is free to make and use it without the payment of a royalty.

A modified sampler made of block tin approximately 30 inches high and 10 inches in diameter, with 20 partitions spaced 1 inch apart around the base of the cone, which is considered a suitable size for grain-grading purposes, is now on the market. The design is so simple that any competent tinner or metal worker should be able to make it at about one-third the cost of the standard "Boerner Sampler." Working plans and specifications may be obtained from the Bureau of Markets, U. S. Department of Agriculture, Washington, D. C.

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